REMARKS

Applicants affirm the election of Group I, claims 15-27 and 29-30, as requested by the Examiner. Claim 28 is now cancelled without prejudice to including the subject matter of claim 28 in a continuing application.

Therefore, claims 15-27 and 29-30 are pending in the application. Claims 15-27 and 29-30 are amended herein. These amendments are supported by the specification as follows.

Claim 15 has been amended to refer to "partial" pyrolytic decomposition, as is recited, for example, in original claim 11.

Claims 15 and 16 have been amended to recite a "C:H stoichiometric ratio". This amendment is supported, for example, by the original claims as well as the paragraph bridging pages 5 and 6 of the specification. This amendment is not intended to narrow the scope of the claims, but is offered for clarity.

Claims 17 and 18 have been amended to recite that the hydrocarbon flames are generated by reaction of the flame fuel with oxygen or air. This amendment is made in lieu of the terms "oxygen-assisted" or "air-assisted", and thus the amendment is supported by the original claims. The amendment is further supported by, for example, page 9 of the specification, lines 23-25. This amendment is not intended to narrow the scope of the claims but to clarify the terms used therein.

The remaining amendments to the claims are formal and/or stylistic in nature. As such, these amendments are also not intended to narrow the scope of the claims, but are intended to clarify their subject matter.

No new matter has been added.

Applicants respectfully request entry of this Amendment.

Claim Rejections Under 35 U.S.C. § 112, First Paragraph

At page 2 of the Office Action, the Examiner rejects claims 15-27, 29 and 30 under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement.

Specifically, the Examiner contends that the specification, while being enabling for making carbon black, does not reasonably provide enablement for making fullerenes, and thus, the specification is not enabling commensurate in scope with the claims. Further, the Examiner contends that the use of subscripts in claim 15 incorrectly implies that the claimed process produces a compound with a definite formula. In addition, the Examiner contends that the specification at page 2 provides a formula for soot that the Examiner believes is speculative.

Applicants request reconsideration of this rejection for the following reasons.

First, it is basic U.S. patent law that the claims should be construed in light of the specification, and not read in a vacuum. There is nothing in the present specification to suggest that one can produce any or every particular structure of carbonaceous solid of the recited formula. The specification does not refer to the specific structure of the solid which will be produced by the claimed process, but instead provides a general formula that covers the types of carbonaceous solids which might be generated. That is, the particular structure of these solids is not specified. It is possible that fullerenes might be produced in the process, but this is certainly not obligatory or specifically intended.

Nevertheless, in the interest of facilitating examination, Applicants have removed the subscripts and amended claim 15 to clarify that the carbonaceous solid is not of a definite structure. This amendment is not intended to narrow the scope of the claims.

With regard to the Examiner's comments concerning the alleged speculative nature of the formula for "soot" at page 2 of the specification, as the word "soot" is not used in the claims the issue of whether or not this formula is speculative is not relevant to the patentability of any claim of this application.

In view of the above, Applicants believe that the amended claims are enabled by the specification, and Applicants respectfully request that this rejection be withdrawn.

Claim Rejections Under 35 U.S.C. § 112, Second Paragraph

At page 3 of the Office Action, the Examiner rejects claims 15-27, 29 and 30 under 35 U.S.C. § 112, second paragraph, as being indefinite.

(1) The Examiner contends that the term "average" renders claim 15 indefinite because it is unclear what factors are considered.

Applicants do not believe that the term "average" renders claim 15 indefinite. Nevertheless, claim 15 has been amended to remove this limitation to more clearly state that the carbonaceous product has a stoichiometric ratio of carbon: hydrogen greater than 2.5:1.

(2) The Examiner contends that the term "rapidly" renders claim 17 indefinite because the term is subjective.

Applicants have removed the term "rapidly" from claim 17.

(3) The Examiner contends that the term "assisted" renders claim 18 indefinite.

Claim 18 has been amended to recite that "said hydrocarbon flames are generated by reaction of the flame fuel with oxygen". Claim 17 has been amended in a similar fashion.

(4) The Examiner contends that the term "interspersed" renders claim 21 indefinite because the term normally refers to a physical admixture or sequence.

Applicants request reconsideration of this rejection because the term "interspersed" is appropriate in this context, that is, the combustion products are "interspersed" with a separate physical entity, namely the feedstock fuel.

(5) The Examiner contends that claims 19 and 20 are indefinite because it is unclear if these claims further limit the temperature.

Claims 19 and 20 have been amended to recite "at least about 1000° C" as in independent claim 15.

The amendments in response to the Section 112, second paragraph rejections do not narrow the scope of the claims.

Applicants believe that the rejections under Section 112, second paragraph have been adequately addressed, and accordingly, Applicants respectfully request withdrawal of these rejections.

Claim Rejections Under 35 U.S.C. § 102(b) / 103(a)

(1) At page 4 of the Office Action, claims 15-27, 29 and 30 are rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,527,518 to Lynum *et al.*

Specifically, the Examiner contends that Lynum teaches making carbon black by heating hydrocarbons in a flame, and recycling the hydrogen to burn for heat. The Examiner admits that Lynum does not teach the recited formula, but contends that Lynum teaches, and the present claims encompass, making carbon black. The Examiner further contends that Lynum teaches optionally adding oxidant to the gas environment to alter the carbon produced.

Applicants respectfully request reconsideration of this rejection because Lynum does not teach a process as claimed in the present invention and optimization of the process of Lynum would not lead to the claimed process. Applicants explain as follows.

Lynum does not teach the use of any combustion process and quite specifically teaches a decomposition process, as evident from column 1, lines 9-11 and 52-59 of Lynum. Further, in claim 1 of Lynum, in a first stage, pyrolytic decomposition is performed, and in a second stage, complete decomposition is achieved (also see column 5 of Lynum). Thus, in the process of Lynum, carbon black is produced by complete decomposition of the feedstock.

Further, while Lynum in column 2, lines 46 to 51, suggests the use of an oxidizing medium, this is suggested only to modify the *pre-formed* carbon black's physical properties. This is further evident from Example 7 (column 5, line 45) which refers to the use of further raw materials to cause quenching and to react with the *"already produced carbon black"* to change the properties of that carbon black. Also see claim 1 which refers to adding additional raw materials to cause quenching after the second stage.

Thus, the carbon black produced by the process of Lynum is not produced by combustion processes but simply by decomposition. As the addition of oxygen during production of the

carbon black would be an entirely different process (combustion), adding oxygen during the production of the carbon black is not optimization of the method of Lynum (which employs decomposition).

On the other hand, the present claims recite that incomplete combustion is used to produce the solid carbonaceous product (see, for example, claim 15), and such is not taught by Lynum. For example, in the claimed process, oxygen has a very specific and essential role in the formation of the solid carbonaceous product, because it is able to produce very high localized temperatures in the so-called fine structures of the turbulence. These temperatures may exceed 3000°C. This creates extremely localized heating which leads to the spontaneous formation of nuclei, the precursor to carbon black particles, by incomplete combustion.

Because this process is strongly endothermic, the temperature in the reactor drops as the carbon black particles are formed, until the reactions causing particle formation are quenched. This quenching occurs without the need to add additional raw materials, in contrast to the process taught by Lynum. The use of only a limited amount of the oxidant prevents combustion of the carbon black thus formed. This effectively instant quenching is automatically possible by virtue of the limited oxygen. The automatic nature of the quenching produces a reliable, self-controlled process for the production of the solid carbonaceous product.

Production of the solid carbonaceous product without the use of an added quenching agent is particularly unexpected and not suggested by Lynum. The particulates thus produced are not contaminated by contact with a quenching agent, and since quenching occurs inherently, the process is eminently controllable.

In addition, the method of the present invention is highly energy efficient because it directly uses the energy in fuel. On the other hand, the process of Lynum uses electricity, which is generally produced in a thermal process by burning a hydrocarbon fuel. In an efficient plant, approximately 50% of the energy in the fuel is converted into electrical energy. Further, while the Lynum process itself does not produce carbon dioxide, the generation of the electricity to run the reactor produces carbon dioxide, and yields that electricity with low energy efficiency. Thus, from a broader perspective, the present invention is far more energy efficient and environmentally friendly than the process of Lynum.

In conclusion, the production of the solid carbonaceous product using the present invention: is achieved by an entirely different process than Lynum, is not simply optimization of the process of Lynum, is inherently controllable, produces low levels of carbon dioxide, and is energy efficient.

In view of the above, Lynum does not teach or suggest the invention recited by the current claims, and Applicants respectfully request reconsideration and withdrawal of this rejection.

(2) At page 4 of the Office Action, claims 15-21, 23-26, 29 and 30 are rejected under 35 U.S.C. § 102(b) as anticipated by, or in the alternative, under 35 U.S.C. 103(a) as obvious over U.S. Patent No. 3,619,140 to Morgan *et al.*

Specifically, the Examiner contends that Morgan teaches making a hot flame and burning oil at sub-stoichiometric oxygen levels to make carbon black. The Examiner admits that Morgan

does not teach the recited formula, but contends that Morgan does teach, and the present claims encompass, making carbon black.

Applicants request reconsideration of this rejection for the following reasons.

In the process of Morgan, combustion is performed to a significant extent and is unlike the controlled combustion of the presently claimed process, wherein the level of oxygen is specifically limited (**a C:O stoichiometric ratio greater than 1:0.4 as recited in claim 15**). If a ratio of 1:0.4 is used, which is the highest ratio literally encompassed by the present claims, a combustion of 10% could be achieved. This can be calculated by reference to the equation on page 1 of the specification, which indicates that complete combustion requires four oxygen molecules to every one carbon molecule. The use of 0.4 oxygen molecules therefore constitutes 10% of the requirement to achieve full combustion.

Morgan, on the other hand, refers to much higher levels of combustion. See Example 1 of Morgan which refers to 29.1% combustion, and the other examples of Morgan illustrate similarly high levels of combustion. Further, the yield indicated in Example 1 of Morgan is 35% based on the total carbon yield. In contrast using the method as claimed, a yield of 0.375 kg per kg of methane can be achieved (see page 4 of the specification, last paragraph) which corresponds to a 50% yield when taking into account the carbon component only, ie. 50% of the available carbon molecules are converted into the carbonaceous product. Thus the present invention allows significantly higher levels of the desired product to be achieved.

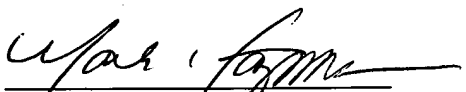
In conclusion, Morgan does not teach or suggest the present invention as recited by the claims of this application, because Morgan does not teach the reduction in oxygen required to achieve greater yield, greater energy efficiency, or an improved product.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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